

Appl. No. 09/503,676  
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Reply to Office Action of May 2, 2003

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (currently amended) In a network having a ~~plurality of~~ sending computer system and a receiving computer systems system, each of the sending and receiving computer systems including a processor, a memory and a network adapter, the memory containing a data structure used for storing a common data buffer, a method for ~~the~~ sending and receiving of ~~application program~~ payload data by layers or sub-layers of at least one communications protocol ~~without recopying of the application program data,~~ the method comprising the steps of:

~~under control of a sending computer system;~~

(a) ~~storing in a plurality of pointers to locations within the common data buffer, a~~ first start pointer and an end location of a next slice of data being sent pointing to a first byte of the payload data in a first common data buffer of the sending computer system;

(b) ~~adding an appropriate a first header to the slice of data being sent by placing the header~~ payload data in the first common data buffer at a location immediately preceding the location within the common data buffer byte pointed to by the first start pointer according to a first protocol layer of the communications protocol at the sending computer system; and

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- (c) adjusting the first start pointer to point to a memory location within the common data buffer of a first byte of the first header added to the data contained in the common data buffer; and
- (d) invoking a send procedure of a second and next lower protocol layer of the communications protocol at the sending computer system; and
- (e) transferring to the second protocol layer the start pointer by the send procedure, wherein the payload data is not copied in preparation for or during the send procedure by an address reference the slice of data to be sent by the next lower protocol layer; and
- (f) adding a second header to the payload data in the first common data buffer at a location preceding the first start pointer;
- (g) sending the payload data and the first and second headers to the receiving computer system;
- under control of a receiving computer system;
- (h) storing the payload data and the first and second headers in a second common data buffer of the receiving computer system;
- (i) invoking a receive method procedure of a second next lower protocol layer of the communications protocol at the receiving computer system;
- (j) storing a second start pointer pointing to a first byte of the second header in the second common data buffer;
- (k) processing and removing any header added to a received slice of data from the send procedure of the same protocol layer level on the sending computer system by

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adjusting ~~a the second~~ start pointer to point to the first byte of the first header according to the second protocol layer at the receiving computer system; initially pointing to a memory location within the common data buffer of a first byte of the header to point to a first memory location within the common data buffer following the header; and to point to the first byte of the first header; and

~~exiting and returning by an address reference to a receive procedure of a next higher protocol layer the received slice of data~~

(l) invoking a receive procedure of a first and higher protocol layer of the communications protocol at the receiving computer system; and

(m) transferring to the first protocol layer at the receiving computer system the second start pointer, wherein the payload data is not copied in preparation for or during the receive procedure.

2. (currently amended) In a computer system including a processor, a memory and a network adapter, the memory containing a data structure used for storing a common data buffer, a method for ~~the sending of application program~~ payload data by layers or sub-layers of at least one communications protocol ~~without recopying of the application program data,~~ the method comprising the steps of:

(a) storing in a plurality of pointers to locations within the common data buffer, a start pointer and an end location of a next slice of data being sent pointing to a first byte of the payload data in the common data buffer of the sending computer system;

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(b) adding ~~an appropriate~~ a first header to the ~~slice of data being sent~~ payload data by placing the header in the common data buffer at a location immediately preceding the location within the common data buffer byte pointed to by the first start pointer according to a first protocol layer of the communications protocol; and

(c) adjusting the start pointer to point to a ~~memory location within the~~ common data buffer of a first byte of the first header added to the data contained in the common data buffer; and

(d) invoking a send procedure of the ~~next~~ a second and lower protocol layer of the communications protocol at the sending computer system; and

(e) transferring to the second protocol layer the start pointer by the send procedure, wherein the payload data is not copied in preparation for or during the send procedure by an address reference the slice of data to be sent by the next lower protocol layer.

3. (currently amended) The method for ~~sending application data~~ of claims 1 or claim 2 wherein a checksum is added to the header in the common data buffer preceding the ~~slice of~~ payload data being sent.

4. (currently amended) The method for ~~sending application data~~ of claims 1 or claim 2 wherein the transferring step includes any application data or information required by the send procedure of the ~~next~~ second and lower protocol layer.

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5. (currently amended) The method ~~for sending application data of claims 1 or claim 2~~ further comprising the step of (f) adjusting a size of the ~~slice of~~ payload data to be sent by the ~~next second and~~ lower protocol layer by adjusting the end pointer.

6. (currently amended) In a computer system including a processor, a memory and a network adapter, the memory containing a data structure used for storing a common data buffer, a method for ~~the receiving of application program~~ payload data by layers or sub-layers of at least one communications protocol ~~without recopying of the application program data,~~ the method comprising the steps of:

- (a) storing the payload data, a first header, and a second header in the common data buffer of the receiving computer system;
- (b) invoking a receive procedure of a second next lower protocol layer of the communications protocol;
- (c) storing a start pointer and an end pointer to the payload data;
- (d) storing a second start pointer pointing to a first byte of the second header in the common data buffer;
- (e) ~~processing and removing any header added to the received slice of data by a send procedure of the same protocol layer level on a sending computer system by adjusting a the start pointer to point to the first byte of the first header according to the second protocol layer; initially pointing to a memory location within the common data buffer of a first byte of such header to point to a first memory location within the common data buffer following the header; and~~

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~~exiting and returning by an address reference to a receive procedure of a next higher protocol layer the received slice of data~~

(f) invoking a receive procedure of a first and higher protocol layer of the communications protocol; and

(g) transferring to the first protocol layer the start pointer, wherein the payload data is not copied in preparation for or during the receive procedure.

7. (currently amended) The method for ~~receiving application data~~ of ~~claims 1 or claim 6~~ wherein a checksum following the header and added by the sending computer system is removed from the received ~~slice of~~ payload data in the common data buffer.

8. (currently amended) The method for ~~receiving application data~~ of claim 7 wherein the checksum is removed by adjusting the start pointer of the common data buffer to point to ~~the a~~ memory location following the checksum.

9. (currently amended) The method for ~~receiving application data~~ of ~~claims 1 or claim 6~~ further comprising the step of (m) transferring any application data or information required by the receive procedure of the ~~next~~ first and higher protocol layer.

10. (currently amended) A computer system for ~~the sending and receiving of application program~~ payload data by layers or sub-layers of at least one communications

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protocol ~~without recopying of the application program data, the computer system~~

comprising:

a processor for processing data from an application program;

a ~~data structure in memory including a common data buffer used for the storing of~~  
application program data being sent and received;

a ~~sending component that sends for sending application the payload data stored in~~  
said data structure by,

wherein the sending component storing stores in a plurality of pointers to  
locations within the common data buffer, a first start pointer and an end location of a next  
slice of data being sent pointing to a first byte of the payload data in a first common data  
buffer of the sending computer system;

wherein the sending component adding adds an appropriate a first header  
to the slice of data being sent by placing the header payload data in the first common data  
buffer at a location immediately preceding the location within the common data buffer  
byte pointed to by the first start pointer according to a first protocol layer of the  
communications protocol at the sending computer system; and

wherein the sending component adjusting adjusts the first start pointer to  
point to a memory location within the common data buffer of a first byte of the first  
header added to the data contained in the common data buffer; and

wherein the sending component invoking invokes a send procedure of a  
second and next lower protocol layer of the communications protocol at the sending  
computer system; and

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wherein the sending component transferring transfers to the second protocol layer the start pointer by the send procedure, wherein the payload data is not copied in preparation for or during the send procedure by an address reference the slice of data to be sent by the next lower protocol layer; and

wherein the sending component adds a second header to the payload data in the first common data buffer at a location preceding the first start pointer; and

wherein the sending component sends the payload data and the first and second headers to the receiving computer system; and

a receiving component that receives for receiving application the payload data stored in said data structure by,

wherein the receiving component stores the payload data, the first header, and the second header in a second common data buffer of the receiving computer system;

wherein the receiving component invoking invokes a receive procedure of a next lower second protocol layer of the communications protocol at the receiving computer system;

wherein the receiving component adjusts processing and removing any header added to a received slice of data by a send procedure of the same protocol layer level on a sending computer system by adjusting a the second start pointer to point to the first byte of the first header according to the second protocol layer at the receiving computer system; initially pointing to a memory location within the common data buffer



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~~of a first byte of the header to point to a first memory location within the common data buffer following the header; and~~

~~exiting and returning to the receive procedure of a next higher protocol layer the received slice of data~~

wherein the receiving component invokes a receive procedure of a first and higher protocol layer of the communications protocol at the receiving computer system; and

wherein the receiving component transfers to the first protocol layer at the receiving computer system the second start pointer, wherein the payload data is not copied in preparation for or during the receive procedure.

11. (currently amended) A computer system for ~~the sending of application program~~ payload data by layers or sub-layers of at least one communications protocol ~~without recopying of the application program data, the computer system~~ comprising:

a processor ~~that processes~~ for processing data from an application program;

~~a data structure in memory including a common data buffer used for storing of the application data being sent and received;~~

a sending component ~~that sends~~ for sending the payload data stored ~~in said data structure by,~~

wherein the sending component ~~storing~~ stores in a plurality of pointers to locations within the common data buffer, a start pointer and an end location of a next

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slice of data being sent pointing to a first byte of the payload data in a common data buffer of the computer system;

wherein the sending component adding adds an appropriate a first header to the slice of data being sent by placing the header payload data in the common data buffer at a location immediately preceding the location within the common data buffer byte pointed to by the start pointer according to a first protocol layer of the communications protocol; and

wherein the sending component adjusting adjusts the start pointer to point to a memory location within the common data buffer of a first byte of the first header added to the data contained in the common data buffer; and

wherein the sending component invoking invokes a send procedure of a second and next lower protocol layer of the communications protocol; and

wherein the sending component transferring transfers to the second protocol layer the start pointer by the send procedure, wherein the payload data is not copied in preparation for or during the send procedure by an address reference the slice of data to be sent by the next lower protocol layer;

wherein the sending component adds a second header to the payload data in the common data buffer at a location preceding the start pointer; and

wherein the sending component sends the payload data and the first and second headers to a receiving computer system.

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12. (currently amended) The computer system ~~for sending application data of~~  
~~claims 10 or claim 11~~ wherein the sending component ~~that sends application data~~ adds a  
checksum to the header in the common data buffer preceding the ~~slice of~~ payload data  
being sent.

13. (currently amended) The computer system ~~for sending application data of~~  
~~claims 10 or claim 11~~ wherein the sending component ~~that sends application data~~  
transfers any application data or information required by the send procedure of the ~~next~~  
second and lower protocol layer.

14. (currently amended) The computer system ~~for sending application data of~~  
~~claims 10 or claim 11~~ wherein the sending component ~~that sends application data~~ adjusts  
a size of data to be sent by the ~~next~~ second and lower protocol layer by adjusting  
the end pointer.

15. (currently amended) A computer system ~~for the receiving of application~~  
~~program~~ payload data by layers or sub-layers of at least one communications protocol  
~~without recopying of the application program data,~~ the method comprising the steps of:  
a processor ~~that processes~~ for processing data from an application program;  
a data structure in memory ~~including a common data buffer used for storing of the~~  
application data being sent and received;

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a receiving component that receiving for receiving the payload data stored in said data structure by,

wherein the receiving component stores the payload data, a first header, and a second headers in a common data buffer of the computer system;

wherein the receiving component invoking invokes a receive procedure of a second next lower protocol layer of the communications protocol;

wherein the sending component stores a start pointer and an end pointer to the payload data;

wherein the receiving component stores a second start pointer pointing to a first byte of the second header in the common data buffer;

wherein the receiving component adjusts processing and removing any header added to the received slice of data by a send procedure of the same protocol layer level on a sending computer system by adjusting a the start pointer to point to the first byte of the first header according to the second protocol layer; initially pointing to a memory location within the common data buffer of a first byte of such header to point to a first memory location within the common data buffer following the header; and

exiting and returning by an address reference to a receive procedure of a next higher protocol layer the received slice of data

wherein the receiving component invokes a receive procedure of a first and higher protocol layer of the communications protocol; and

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wherein the receiving component transfers to the first protocol layer the start pointer, wherein the payload data is not copied in preparation for or during the receive procedure.

16. (currently amended) The computer system ~~for receiving of application program data of claims 10 or claim 15~~ wherein the receiving component that receives application data removes a checksum added by the sending computer system from the received ~~slice of payload~~ data in the common data buffer.

17. (currently amended) The computer system ~~for receiving of application program data of claim 16~~ wherein the receiving component that receives application data removes the checksum by adjusting the start pointer of the common data buffer to point to the a memory location following the checksum.

18. (currently amended) The computer system ~~for receiving of application program data of claims 10 or claim 15~~ wherein the receiving component that receives application data transfers any application data or information required by the receive procedure of the ~~next~~ first and higher protocol layer.

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19. (currently amended) A computer readable medium containing a computer program for the sending and receiving of ~~application program~~ payload data by layers or sub-layers of at least one communications protocol ~~without recopying of the application program data~~, said the computer program comprising program instructions for:

~~computer program instructions that generate a data structure in a memory including a common data buffer used for storing of the application data being sent and received;~~

~~computer program instructions that send data stored in said data structure by, storing in a plurality of pointers to locations within the common data buffer, a first start pointer and an end location of a next slice of data being sent pointing to a first byte of the payload data in a first common data buffer of the sending computer system;~~

~~adding an appropriate a first header to the slice of data being sent by placing the header payload data in the first common data buffer at a location immediately preceding the location within the common data buffer byte pointed to by the first start pointer according to a first protocol layer of the communications protocol at the sending computer system; and then~~

~~adjusting the first start pointer to point to a memory location within the common data buffer of a first byte of the first header added to the data contained in the common data buffer; and~~

~~invoking a send procedure of a second and next lower protocol layer of the communications protocol at the sending computer system;~~

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transferring to the second protocol layer the start pointer by the send procedure,  
wherein the payload data is not copied in preparation for or during the send procedure by  
an address reference the slice of data to be sent by the next lower protocol layer;

adding a second header to the payload data in the first common data buffer at a  
location preceding the first start pointer;

sending the payload data and the first and second headers to the receiving  
computer system;

computer program instructions that receive data stored in said data structure by,  
invoking a receive procedure of a next lower protocol layer;

processing and removing any header added to a received slice of data by a send  
procedure of the same protocol layer level on a sending computer system by

adjusting a the second start pointer to point to the first byte of the first header  
according to the second protocol layer at the receiving computer system; initially pointing  
to a memory location within the common data buffer of a first byte of the header to point  
to a first memory location within the common data buffer following the header; and

exiting and returning to a receive procedure of a next higher protocol layer the  
received slice of data

invoking a receive procedure of a first and higher protocol layer of the  
communications protocol at the receiving computer system; and

transferring to the first protocol layer at the receiving computer system the second  
start pointer, wherein the payload data is not copied in preparation for or during the  
receive procedure.

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20. (currently amended) A computer readable medium containing a computer program for the sending of application program payload data by layers or sub-layers of at least one communications protocol ~~without recopying of the application program data,~~ said the computer program comprising program instructions for:

~~computer program instructions that generate a data structure in memory including a common data buffer used for storing of the data being sent;~~

~~computer program instructions that send data stored in said data structure by, storing in a plurality of pointers to locations within the common data buffer, a first start pointer and an end location of a next slice of data being sent pointing to a first byte of the payload data in a first common data buffer of the sending computer system;~~

~~adding an appropriate a first header to the slice of data being sent by placing the header payload data in the first common data buffer at a location immediately preceding the location within the common data buffer byte pointed to by the first start pointer according to a first protocol layer of the communications protocol at the sending computer system; and~~

~~adjusting the first start pointer to point to a memory location within the common data buffer of a first byte of the first header added to the data contained in the common data buffer; and~~

~~invoking a send procedure of a second and next lower protocol layer of the communications protocol at the sending computer system; and~~



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transferring to the second protocol layer the start pointer by the send procedure,  
wherein the payload data is not copied in preparation for or during the send procedure by  
an address reference the slice of data to be sent by the next lower protocol layer;  
adding a second header to the payload data in the first common data buffer at a  
location preceding the first start pointer;  
sending the payload data and the first and second headers to the receiving  
computer system.

21. (currently amended) The computer readable ~~program for sending~~  
~~application program data~~ medium of claim 19 or claim 20 wherein the computer  
instructions ~~that send data~~ add a checksum to the header in the common data buffer  
preceding the ~~slice of~~ payload data being sent.

22. (currently amended) The computer readable ~~program for sending~~  
~~application program data~~ medium of claim 19 or claim 20 wherein the computer  
instructions ~~that send data~~ transfer any application data or information required by the  
send procedure of the ~~next~~ second and lower protocol layer.

23. (currently amended) The computer readable ~~program for sending~~  
~~application program data~~ medium of claim 19 or claim 20 wherein the computer  
instructions ~~that send data~~ adjust a size of the payload data to be sent by the ~~next~~ second  
and lower protocol layer by adjusting the end pointer.

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24. (currently amended) A computer readable medium containing a computer program for the receiving of ~~application program~~ payload data by layers or sub-layers of at least one communications protocol ~~without recopying of the application program data,~~ said the computer program comprising program instructions for:

~~computer program instructions that generate a data structure in memory including a common data buffer used for storing of the data being received;~~

~~computer program instructions that receive data stored in said data structure by,~~  
storing the payload data, a first header, and a second header in the common data  
buffer of the receiving computer system;

invoking a receive procedure of a second next lower protocol layer of the  
communications protocol;

storing a start pointer and an end pointer to the payload data;

storing a second start pointer pointing to a first byte of the second header in the  
common data buffer;

~~processing and removing any header added to a received slice of data by a send~~  
~~procedure of the same protocol layer level on a sending computer system by~~

adjusting a the start pointer to point to the first byte of the first header according  
to the second protocol layer; initially pointing to a memory location within the common  
data buffer of a first byte of the header to point to a first memory location within the  
common data buffer following the header; and

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~~exiting and returning to a receive procedure of a next higher protocol layer the received slice of data~~

invoking a receive procedure of a first and higher protocol layer of the communications protocol; and

transferring to the first protocol layer the start pointer, wherein the payload data is not copied in preparation for or during the receive procedure.

25. (currently amended) The computer ~~program product for receiving application program data~~ readable medium of ~~claims 20 or claim~~ 24 wherein the program instructions ~~that receive data~~ remove a checksum added by the sending computer system from the received ~~slice of~~ payload data in the common data buffer.

26. (currently amended) The computer ~~program product for receiving application program data~~ readable medium of claim 25 wherein the program instructions remove the checksum by adjusting the start pointer of the common data buffer to point to ~~the~~ a memory location following the checksum.

27. (currently amended) The computer ~~program product for receiving application program data~~ readable medium of ~~claims 20 or claim~~ 24 wherein the program instructions ~~that receive data~~ transfer any application data or information required by the receive procedure of the next first and higher protocol layer.

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28. (canceled)

29. (new) A method for processing payload data in a computer system using layers of a network communications protocol, the method comprising the steps of:

- (a) storing the payload data in a data buffer;
- (b) processing the payload data using a first protocol layer of the network communications protocol; and
- (c) processing the payload data using a second protocol layer of the network communications protocol, wherein the payload data is not copied during and between being processed by the first and second protocol layers.

30. (new) The method of claim 29 wherein the payload data does not move within the data buffer during and between being processed by the first and second protocol layers.

31. (new) The method of claim 29 wherein the processing step(a) further comprises the steps of:

- (a2) positioning a first pointer to point to a first byte of the payload data; and
- (a3) positioning a second pointer to point to a last byte of the payload data, wherein the first protocol layer uses the first and second pointers to locate the payload data for processing.

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32. (new) The method of claim 31 wherein the processing step (b) further comprises the steps of:

(b2) adding a first element to the payload data; and

(b3) moving the second pointer to point to a last byte of the first element, wherein the first pointer does not move when the first element is added.

33. (new) The method of claim 32 wherein the processing step (c) further comprises the steps of:

(c2) adding a second element to the payload data; and

(c3) moving the second pointer to point to a last byte of the second element, wherein the second protocol layer uses the first and second pointers to locate the payload data and the first element to add the second element, wherein the first pointer does not move when the second element is added.

34. (new) The method of claim 33 wherein the first element comprises a header associated with the first protocol layer.

35. (new) The method of claim 33 wherein the first element comprises a checksum associated with the first protocol layer.

36. (new) The method of claim 33 wherein the second element comprises a header associated with the second protocol layer.

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37. (new) The method of claim 33 wherein the second element comprises a checksum associated with the second protocol layer.

38. (new) A system for processing payload data using layers of a network communications protocol, the system comprising:

a processor for processing data from an application program; and

a component that stores the payload data in a data buffer, processes the payload data using a first protocol layer of the network communications protocol and a second protocol layer of the network communications protocol, wherein the payload data is not copied during and between being processed by the first and second protocol layers.

39. (new) A computer readable medium containing a computer program for processing payload data using layers of a network communications protocol, the computer program comprising program instructions for:

storing the payload data in a data buffer;

processing the payload data using a first protocol layer of the network communications protocol; and

processing the payload data using a second protocol layer of the network communications protocol, wherein the payload data is not copied during and between being processed by the first and second protocol layers.

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40. (new) The computer readable medium of claim 39 wherein the payload data does not move within the data buffer during and between being processed by the first and second protocol layers.

41. (new) The computer readable medium of claim 39 wherein the program instructions for storing the payload data in a data buffer further comprise program instructions for:

positioning a first pointer to point to a first byte of the payload data; and

positioning a second pointer to point to a last byte of the payload data, wherein the first protocol layer uses the first and second pointers to locate the payload data for processing.

42. (new) The computer readable medium of claim 41 wherein the program instructions for processing the payload data using a first protocol layer further comprise program instructions for:

adding a first element to the payload data; and

moving the second pointer to point to a last byte of the first element, wherein the first pointer does not move when the first element is added.

43. (new) The computer readable medium of claim 42 wherein the program instructions for processing the payload data using a second protocol layer further comprise program instructions for:

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adding a second element to the payload data; and

moving the second pointer to point to a last byte of the second element, wherein the second protocol layer uses the first and second pointers to locate the payload data and the first element to add the second element, wherein the first pointer does not move when the second element is added.

44. (new) The computer readable medium of claim 43 wherein the first element comprises a header associated with the first protocol layer.

45. (new) The computer readable medium of claim 43 wherein the first element comprises a checksum associated with the first protocol layer.

46. (new) The computer readable medium of claim 43 wherein the second element comprises a header associated with the second protocol layer.

47. (new) The computer readable medium of claim 43 wherein the second element comprises a checksum associated with the second protocol layer.